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# Winter Arthropods in Selected Habitats of Northern Mixedgrass Prairie

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*Abstract.*—Arthropods were collected from February through April in southeastern Wyoming using pitfall traps set under cattle dung pats in open habitats and near snow fences. Arthropods were active throughout the winter months. Only adults were collected; beetles were the predominant organisms and spiders were the most numerous predators. Greater arthropod activity occurred near snow banks than in open grassland habitat. Predator abundance increased, while prey abundance decreased, with time. Thus, predator:prey ratios increased from early to late winter.

Studies of arthropods in adverse conditions have been conducted in several ecosystems. There is considerable information concerning arthropod fauna in arctic and high altitude habitats (Laws, 1984; Gottingen, 1968) and chronic cold is perhaps the most intensively studied adverse condition. Several insects have evolved physiological or behavioral mechanisms for protection against cold temperatures. Antifreeze agents, like those in polar fish, accumulate in the hemolymph of various species of insects, particularly overwintering beetles (Duman, 1979; Patterson and Duman, 1979). A variety of insects engage in behavioral thermoregulation in order to function in both excessively hot and cold habitats (Casey, 1981). However, many insects, such as ants and termites, are not well adapted for the cold conditions associated with high latitudes and elevations (Jeanne and Davidson, 1984). While frost resistance and tolerance are taxonomically incongruous (Heinrich, 1981), cold hardiness manifests some ecological consistency. For example, arthropod predators tend to have thermal activity thresholds higher than their prey (Campbell, 1974). Indeed, ecologically stable communities apparently exist and function throughout the winter in subnivean habitats (Aitchison 1984a, b).

Despite a substantial amount of literature on insect ecology in chronically cold habitats, relatively little data are available on the arthropods of periodically cold habitats, such as winter fauna in temperate zones. Specifically, there appears to be no information concerning arthropod activity during winter months in the western rangeland of the United States. This study was undertaken to determine which, if any, arthropod taxa were active during the winter in selected habitats of Wyoming rangeland and to examine the quantitative relationships between predators and prey.

## MATERIALS AND METHODS

Forty pitfall traps were randomly placed under individual cattle dung pats, on northern mixedgrass prairie, 14 km northwest of Laramie, Wyoming. Twenty traps

were placed 3 m apart along two intersecting transects in: 1) an open area which was fully exposed to environmental conditions and 2) an area which was protected from wind by an adjacent snow fence and associated snow banks. Traps placed in an open area were subjected to more wind and less snow accumulation than traps placed near snow fences/banks. Pitfall traps were checked every two weeks beginning February 5 and ending April 31. Specimens were placed into vials of 70% ethanol and brought to the laboratory for identification. Thus, the degree of influence of specific habitat conditions on arthropod abundance and overwintering behavior was determined.

## Results and Discussion

The winter of 1987 was sporadic in terms of temperature and snowfall (Fig. 1). Temperatures ranged from –15 to 9°C and were above freezing for a number of days. Snowfall was irregular and the exposed areas were clear of snow for long periods of time. However, snow banks formed around snow fences in February and did not melt until mid-April.

In the course of the study, 106 adult arthropods, representing four orders and five families and species were collected from pitfall traps (Table 1). Coleoptera was the most abundant order, followed by Araneae, Homoptera and Acarina. The greatest number of arthropods collected was in March, followed by February and April. The curculionid, *Hyperodes macuicolli* (Kby), was found only in February; the cicadellid, *Cuerna alpina* Melickar, occurred in February and March; the tenebrionid, *Eleodes extricatus* (Say), was found only in April, and the spider, *Schizocosa* sp. and the elaterid, *Anthracopteryx hiemali* Hern, were present February through April. Acari and Coleoptera (Carabidae, Cantharidae and Staphylinidae) are known to be winter-active in subnivean habitats (Aitchison 1979a, b), although this appears to be the first report of winter-active Homoptera, Elateridae and Curculionidae on western rangeland. Lycosid spiders were the only predators found throughout the course of this study. These spiders have also been found to be winter-active in subnivean habitats (Aitchison, 1983, 1984).

Arthropods were ca. 12 times more abundant in protected habitats (n = 98) than in exposed habitats (n = 8), with the greatest differences occurring in February and March. Thus, it appears that the presence of snow banks increased the local abundance of arthropods; the climate in this microhabitat may have been less severe than that of exposed areas. The role of snow banks in increasing arthropod abundance is further supported by the corresponding decrease in arthropod numbers and snow banks in April, despite an increase in the daily mean temperature. *A. hiemali* and *E. extricatus* were the only arthropods found in both exposed and protected habitats. *A. hiemali* was collected from traps placed near snow banks 97% of the time, indicating a strong predilection for protected habitats. *E. extricatus* was found near snow banks only 57% of the time. The apparent lack of preference for protected habitats by *E. extricatus* is reasonable given the decreasing availability of snow banks in April, the time at which this species is active. The remaining arthropods, *H. macuicolli, C. alpina* and *Schizocasa* sp., were found only in protected habitats.

The predator:prey ratio was heavily biased towards prey in February and March (1:12) but reversed to favor predators (2:1) in April. The change in the ratio was due to both an increase in the abundance of *Schizocosa* sp. (from an average of two in

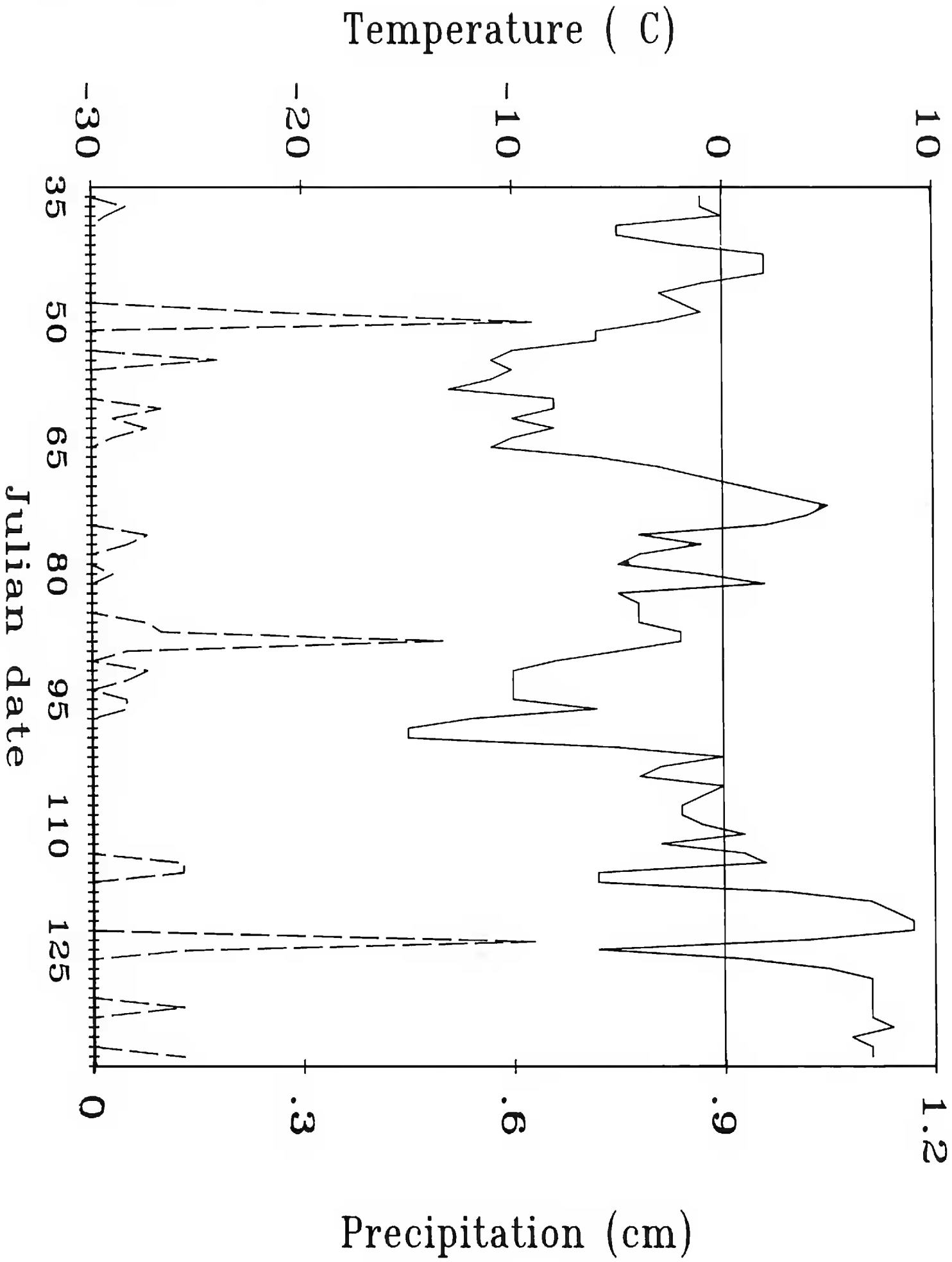


Fig. 1 Mean daily temperature (solid line) and precipitation (broken line) from February through April, 1987 in Albany County, Wyoming.

Table 1. Abundance and predator:prey ratios of rangeland winter adult arthropods collected from selected habitats in Wyoming.

| Month | Habitat | Predator: Prey | Taxa present: Order | Family | Genus and Species | No. |
|---|---|---|---|---|---|---|
| Feb. | Exposed | 0:1 | Coleoptera | Elateridae | *Anthracopteryx hiemali* Hern | 2 |
| | | | TOTAL | | | 2 |
| | Protected | 1:16 | Coleoptera | Elateridae | *Anthracopteryx hiemali* | 20 |
| | | | Coleoptera | Curculionidae | *Hyperodes macuicolli* (Kby) | 2 |
| | | | Homoptera | Cicadellidae | *Cuerna alpina* Melickar | 10 |
| | | | Araneae | Lycosidae | *Schizocosa* sp. | 2 |
| | | | TOTAL | | | 34 |
| Mar. | Exposed | 0:0 | TOTAL | | | 0 |
| | Protected | 1:10 | Coleoptera | Elateridae | *Anthracopteryx hiemali* | 36 |
| | | | Homoptera | Cicadellidae | *Cuerna alpina* | 2 |
| | | | Araneae | Lycosidae | *Schizocosa* sp. | 2 |
| | | | TOTAL | | | 40 |
| Apr. | Exposed | 0:1 | Coleoptera | Tenebrionidae | *Eleodes extricatus* (Say) | 3 |
| | | | Acari | | | 3 |
| | | | TOTAL | | | 6 |
| | Protected | 2:1 | Coleoptera | Elateridae | *Anthracopteryx hiemali* | 3 |
| | | | Coleoptera | Tenbrionidae | *Eleodes extricatus* | 4 |
| | | | Araneae | Lycosidae | *Schizocosa* sp. | 15 |
| | | | TOTAL | | | 22 |

February and March to 15 in April) and a decrease in the abundance of prey species (from an average of 36 in February and March to seven in April). This shift in predatory:prey ratio is consistent with the general trend of predators having higher thermal activity thresholds than their prey (Campbell, 1974).

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